MATHEMATICS STANDARD ARTICULATED BY GRADE LEVEL

HIGH SCHOOL

Strand 1: Number Sense and Operations

Every student should understand and use all concepts and skills from the previous grade levels. The standards are designed so that new learning builds on preceding skills and are needed to learn new skills. Communication, Problem-solving, Reasoning & Proof, Connections, and Representation are the process standards that are embedded throughout the teaching and learning of mathematical strands.

Concept 1: Number Sense

Understand and apply numbers, ways of representing numbers, the relationships among numbers and different number systems.

PO 1.   Classify real numbers as members of one or more subsets: natural, whole, integers, rational, or irrational numbers.

PO 2.   Identify properties of the real number system: commutative, associative, distributive, identity, inverse, and closure.

PO 3.   Distinguish between finite and infinite sets of numbers.

Concept 2: Numerical Operations

Understand and apply numerical operations and their relationship to one another.

PO 1.   Select the grade-level appropriate operation to solve word problems.

PO 2.   Solve word problems using grade-level appropriate operations and numbers.

PO 3.   Simplify numerical expressions including signed numbers and absolute values.

PO 4.   Apply subscripts to represent ordinal position.

PO 5.   Use grade level-appropriate mathematical terminology.

PO 6.   Compute using scientific notation.

PO 7.   Simplify numerical expressions using the order of operations.

Concept 3: Estimation

Use estimation strategies reasonably and fluently.

PO 1.   Solve grade-level appropriate problems using estimation.

PO 2.   Determine if a solution to a problem is reasonable.

PO 3.   Determine rational approximations of irrational numbers.

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HIGH SCHOOL

Strand 2: Data Analysis, Probability, and Discrete Mathematics

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Concept 1: Data Analysis (Statistics)
Understand and apply data collection, organization and representation to analyze and sort data.

PO 1. Formulate questions to collect data in contextual situations.

PO 2. Organize collected data into an appropriate graphical representation.

PO 3. Display data as lists, tables, matrices, and plots.

PO 4. Construct equivalent displays of the same data.

PO 5. Identify graphic misrepresentations and distortions of sets of data.

PO 6. Identify which of the measures of central tendency is most appropriate in a given situation.

PO 7. Make reasonable predictions based upon linear patterns in data sets or scatter plots.

PO 8. Make reasonable predictions for a set of data, based on patterns.

PO 9. Draw inferences from charts, tables, graphs, plots, or data sets.

PO 10. Apply the concepts of mean, median, mode, range, and quartiles to summarize data sets.

PO 11. Evaluate the reasonableness of conclusions drawn from data analysis.

PO 12. Recognize and explain the impact of interpreting data (making inferences or drawing conclusions) from a biased sample.

PO 13. Draw a line of best fit for a scatter plot.

PO 14. Determine whether displayed data has positive, negative, or no correlation.

PO 15. Identify a normal distribution.

PO 16. Identify differences between sampling and census.

PO 17. Identify differences between biased and unbiased samples.

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Concept 2: Probability
Understand and apply the basic concepts of probability.

PO 1.	Find the probability that a specific event will occur, with or without replacement.
PO 2.	Determine simple probabilities related to geometric figures.
PO 3.	Predict the outcome of a grade-level appropriate probability experiment.
PO 4.	Record the data from performing a grade-level appropriate probability experiment.
PO 5.	Compare the outcome of an experiment to predictions made prior to performing the experiment.
PO 6.	Distinguish between independent and dependent events.
PO 7.	Compare the results of two repetitions of the same grade-level appropriate probability experiment.

Concept 3: Discrete Mathematics – Systematic Listing and Counting
Understand and demonstrate the systematic listing and counting of possible outcomes.

PO 1.	Determine the number of possible outcomes for a contextual event using a chart, a tree diagram, or the counting principle.
PO 2.	Determine when to use combinations versus permutations in counting objects.
PO 3.	Use combinations or permutations to solve contextual problems.

Concept 4: Vertex-Edge Graphs
Understand and apply vertex-edge graphs.
(Grades K-8)

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Strand 3: Patterns, Algebra, and Functions

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Concept 1: Patterns

Identify patterns and apply pattern recognition to reason mathematically.

PO 1.   Communicate a grade-level appropriate iterative or recursive pattern, using symbols or numbers.

PO 2.   Find the nth term of an iterative or recursive pattern.

PO 3.   Evaluate problems using basic recursion formulas.

Concept 2: Functions and Relationships

Describe and model functions and their relationships.

PO 1.   Determine if a relationship is a function, given a graph, table, or set of ordered pairs.

PO 2.   Describe a contextual situation that is depicted by a given graph.

PO 3.   Identify a graph that models a given real-world situation.

PO 4.   Sketch a graph that models a given contextual situation.

PO 5.   Determine domain and range for a function.

PO 6.   Determine the solution to a contextual maximum/minimum problem, given the graphical representation.

PO 7.   Express the relationship between two variables using tables/matrices, equations, or graphs.

PO 8.   Interpret the relationship between data suggested by tables/matrices, equations, or graphs.

PO 9.   Determine from two linear equations whether the lines are parallel, perpendicular, coincident, or intersecting but not perpendicular.

Concept 3: Algebraic Representations

Represent and analyze mathematical situations and structures using algebraic representations.

PO 1.   Evaluate algebraic expressions, including absolute value and square roots.

PO 2.   Simplify algebraic expressions.

PO 3.   Multiply and divide monomial expressions with integral exponents.

PO 4.   Translate a written expression or sentence into a mathematical expression or sentence.

PO 5.   Translate a sentence written in context into an algebraic equation involving multiple operations.

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PO 6.   Write a linear equation for a table of values.

PO 7.   Write a linear algebraic sentence that represents a data set that models a contextual situation.

PO 8.   Solve linear (first degree) equations in one variable (may include absolute value).

PO 9.   Solve linear inequalities in one variable.

PO 10.   Write an equation of the line given: two points on the line, the slope and a point on the line, or the graph of the line.

PO 11.   Solve an algebraic proportion.

PO 12.   Solve systems of linear equations in two variables (integral coefficients and rational solutions).

PO 13.   Add, subtract, and perform scalar multiplication with matrices.

PO 14.   Calculate powers and roots of real numbers, both rational and irrational, using technology when appropriate.

PO 15.   Simplify square roots and cube roots with monomial radicands (including those with variables) that are perfect squares or perfect cubes.

PO 16.   Solve square root radical equations involving only one radical.

PO 17.   Solve quadratic equations.

PO 18.   Identify the sine, cosine, and tangent ratios of the acute angles of a right triangle.

Concept 4: Analysis of Change

Analyze change in a variable over time and in various contexts.

PO 1.   Determine slope, x-, and y-intercepts of a linear equation.

PO 2.   Solve formulas for specified variables.

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Strand 4: Geometry and Measurement

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Concept 1: Geometric Properties
Analyze the attributes and properties of 2- and 3-dimensional shapes and develop mathematical arguments about their relationships.

PO 1.   Identify the attributes of special triangles (isosceles, equilateral, right).

PO 2.   Identify the hierarchy of quadrilaterals.

PO 3.   Make a net to represent a 3-dimensional object.

PO 4.   Make a 3-dimensional model from a net.

PO 5.   Draw 2-dimensional and 3-dimensional figures with appropriate labels.

PO 6.   Solve problems related to complementary, supplementary, or congruent angle concepts.

PO 7.   Solve problems by applying the relationship between circles, angles, and intercepted arcs.

PO 8.   Solve problems by applying the relationship between radii, diameters, chords, tangents, or secants.

PO 9.   Solve problems using the triangle inequality property.

PO 10. Solve problems using special case right triangles.

PO 11. Determine when triangles are congruent by applying SSS, ASA, AAS, or SAS.

PO 12. Determine when triangles are similar by applying SAS, SSS, or AA similarity postulates.

PO 13. Construct a triangle congruent to a given triangle.

PO 14. Solve contextual situations using angle and side length relationships.

Concept 2: Transformation of Shapes
Apply spatial reasoning to create transformations and use symmetry to analyze mathematical situations.

PO 1.   Sketch the planar figure that is the result of two or more transformations.

PO 2.   Identify the properties of the planar figure that is the result of two or more transformations.

PO 3.   Determine the new coordinates of a point when a single transformation is performed on a planar geometric figure.

PO 4.   Determine whether a given pair of figures on a coordinate plane represents a translation, reflection, rotation, or dilation.

PO 5.   Classify transformations based on whether they produce congruent or similar figures.

PO 6.   Determine the effects of a single transformation on linear or area measurements of a planar geometric figure.

Concept 3: Coordinate Geometry
Specify and describe spatial relationships using coordinate geometry and other representational systems.

PO 1.   Graph a quadratic equation with lead coefficient equal to one.

PO 2.   Graph a linear equation in two variables.

PO 3.   Graph a linear inequality in two variables.

PO 4.   Determine the solution to a system of equations in two variables from a given graph.

PO 5.   Determine the midpoint between two points in a coordinate system.

PO 6.   Determine changes in the graph of a linear function when constants and coefficients in its equation are varied.

PO 7.   Determine the distance between two points in the coordinate system.

Concept 4: Measurement - Units of Measure
- Geometric Objects
Understand and apply appropriate units of measure, measurement techniques, and formulas to determine measurements.

PO 1.   Calculate the area of geometric shapes composed of two or more geometric figures.

PO 2.   Calculate the volumes of 3-dimensional geometric figures.

PO 3.   Calculate the surface areas of 3-dimensional geometric figures.

PO 4.   Compare perimeter, area, or volume of figures when dimensions are changed.

PO 5.   Find the length of a circular arc.

PO 6.   Find the area of a sector of a circle.

PO 7.   Solve for missing measures in a pyramid (i.e., slant height, height).

PO 8.   Find the sum of the interior and exterior angles of a polygon.

PO 9.   Solve scale factor problems using ratios and proportions.

PO 10.   Solve applied problems using similar triangles.

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Strand 5: Structure and Logic

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Concept 1: Algorithms and Algorithmic Thinking

Use reasoning to solve mathematical problems in contextual situations.

PO 1.   Determine whether a given procedure for simplifying an expression is valid.

PO 2.   Determine whether a given procedure for solving an equation is valid.

PO 3.   Determine whether a given procedure for solving a linear inequality is valid.

PO 4.   Select an algorithm that explains a particular mathematical process.

PO 5.   Determine the purpose of a simple mathematical algorithm.

PO 6.   Determine whether given simple mathematical algorithms are equivalent.

Concept 2: Logic, Reasoning, Arguments, and Mathematical Proof

Evaluate situations, select problem-solving strategies, draw logical conclusions, develop and describe solutions and recognize their applications.

PO 1.   Draw a simple valid conclusion from a given *if…then* statement and a minor premise.

PO 2.   List related *if… then* statements in logical order.

PO 3.   Write an appropriate conjecture given a certain set of circumstances.

PO 4.   Analyze assertions related to a contextual situation by using principles of logic.

PO 5.   Identify a valid conjecture using inductive reasoning.

PO 6.   Distinguish valid arguments from invalid arguments.

PO 7.   Create inductive and deductive arguments concerning geometric ideas and relationships, such as congruence, similarity, and the Pythagorean relationship.

PO 8.   Critique inductive and deductive arguments concerning geometric ideas and relationships, such as congruence, similarity, and the Pythagorean relationship.

PO 9.   Identify a counterexample for a given conjecture.

PO 10. Construct a counterexample to show that a given conjecture is false.

PO 11. State the inverse, converse, or contrapositive of a given statement.

PO 12. Determine if the inverse, converse, or contrapositive of a given statement is true or false.

PO 13. Construct a simple formal or informal deductive proof.

PO 14. Verify characteristics of a given geometric figure using coordinate formulas such as distance, mid-point, and slope to confirm parallelism, perpendicularity, and congruency.